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STATIC AND MONOHARMONIC ACOUSTIC IMPACT ON A LAMINATED PLATE

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A discrete layered damping model of a multilayer plate at small displacements and deformations, with account of the internal damping of layers according to the Thompson–Kelvin–Voight model, is presented. Based on the equations derived, an analytical solution to the static deformation problem for single-layer rectangular plate hinge-supported along its contour and subjected of a uniformly distributed pressure applied to one of its boundary planes is obtained. Its convergence to the three-dimensional solution is analyzed in relation to the dimension of mesh in the thickness direction of the plate. It is found that, for thin plates, the dimension of the problem formulated can be reduced on the basis of simplified hypotheses applied to each layer. An analytical solutions is also constructed for the forced vibrations of two- and three-layer rectangular plates hinged in the opening of an absolutely stiff dividing wall upon transmission of a monoharmonic sound wave through them. It was assumed that the dividing wall is situated between two absolutely stiff barriers; one of them, owing to the harmonic vibration with a given displacement amplitude of the plate, forms an incident sound wave, and the other is stationary and is coated by a energy-absorbing material with high damping properties. Behavior of the acoustic media in spaces between the deformable plate and the barriers is described by the classical wave equations based on the model of an ideal compressible fluid. To describe the process of dynamic deformation of the energy-absorbing coating of the fixed barrier, two-dimensional equations of motion are derived based on the model of a transversely soft layer, a linear approximation of displacement fields in the thickness direction of the coating, and the account of damping properties of its material by using the hysteresis model. The effect of physical and mechanical parameters of the mechanical system considered and of frequency of the incident sound wave on the parameter of its sound insulation, and the characteristics of stress-strain state of the plate is investigated

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